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Assessment of Solar Ultraviolet Radiation behavior in Maputo-Mozambique

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Abstract
The Energy Research programme committed more often than not in providing technical and scientific training in renewable energy, scientific research, outreach for the communities and promotion of the usage of renewable energy technologies systems, has developed a solar radiation laboratory mainly to create a database from which research and several works on assessment of the potential of solar radiation can be based on. Solar radiation is a small part of electromagnetic spectrum. The solar radiation spectrum (SRS) is commonly divided into three main regions; the ultraviolet (UV) region, the visible (VIS) region and the infrared (IR) region. This poster is concerned to evaluate daily and seasonal variations of solar ultraviolet radiation (SUVR) reaching the earth's surface in Maputo between June and December. The main objective is to provide an information tool for the assessment of public health implications from human exposure to solar ultraviolet radiation. The results show that the amount of SUVR that reaches the earth's surface in Maputo varies with time increasing from winter to summer and is somehow high.

Introduction

The ultraviolet radiation represents a small portion of the solar radiation spectrum (SRS) that, extends from the wavelength of ~200 nm to ~400 nm [Diffey, 1991]. The human eyes can not detects the UV radiation. The UV region is commonly subdivided into three main regions, namely UVA, UVB and UVC.

It is important to emphasize that the subdivisions are likely arbitrary and differ somewhat according to the concerns of the discipline involved [Diffey, 1991]. The atmosphere is transparent to solar UV radiation that is in wavelength between 320 and 400 nm (UVA).

Mozambique, is situated between 10º 27' and 26º 52' S this suggests that the amount of SUVR that reaches the earth's surface is high and the majority, namely 80 %, of the population in Mozambique is active in agriculture and the urban population in and around Maputo particularly, practice informal business as a subsistence mode, and hence experiencing extended period of exposure to SUVR. It is believed that many of then ignore the health risks from solar UV radiation exposure and also the protective manners. Therefore, there is a high probability of many people be affected by diseases which are SUVR associated. This assessment could be a good start for the evaluation of the real health impacts from SUVR exposure that can enable to produce appropriate, consistent and positive messages derived from credible sources for all levels of community, in order to reduce exposure and related health risks associated with solar ultraviolet radiation.

Spatial distribution of SUVR.

The quality and quantity of SUVR at the Earth's surface depend on variety of factors, such as the energy output of the Sun, the absorption by ozone, the latitude, the time of day, the time of year (season), the elevation above sea level (altitude), the transmission properties of the atmosphere (which vary with the cloud coverage and turbidity) proximity to an industrial area and surface reflection (albedo).

Public health implications of the SUVR.

Human exposure to solar ultraviolet radiation has important public health implications. Evidence of harm associated with overexposure to SUVR has been demonstrated in many studies (Lucas et al, 2006). Absence of exposure to SUVR causes a lack of vitamin D with subsequent effects on calcium and phosphorus levels and eventually rickets, osteomalacia and osteoporosis. Excess exposure to SUVR is a relatively new problem, occasioned by less coverage by clothing, migration of pale-skinned peoples to areas of high ambient UVR and behavioural practices such as sunbathing (Lucas et al 2006).

Results and discussions.

Several measurements of SUVR have been carried out since May 2006, with a view to provide a tool for evaluation of its implication in health and also technical applications. Theoretically on a clear sky conditions, solar ultraviolet radiation increases from the sunrise and reaches the peak intensity at solar noon on a daily basis, since the pathlength of solar rays through atmosphere decreases from the sunrise up to solar noon and thereafter increases reaching the maximum value at sunset.

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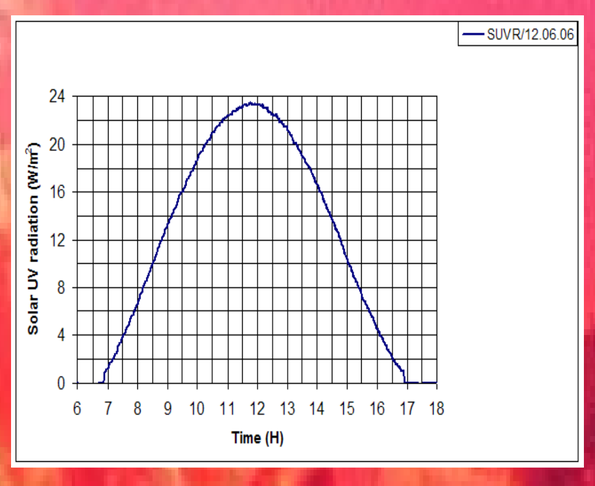
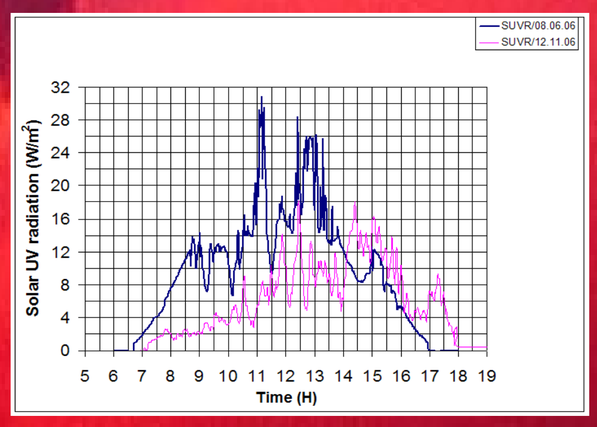
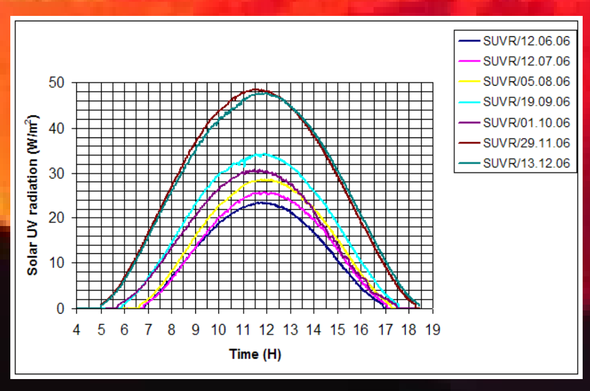


The plot in Fig.1 indicates zero values at approximately 6h: 55 and around 17h: 00 that is, the sun rose at around 6h: 55 and it set at around 17h: 00. SUVR achieves the highest values within the period between approximately 10h: 00 and 13h: 30. This means that people must strongly take precaution in order to avoid exposure to SUVR along that period so that health risks from SUVR exposure are reduced.

When the sky is cloud covered the amount of solar UV radiation that reaches the earth's surface is expected to be low. Nevertheless, is not advisable to expose for prolonged period of time since clouds do not eliminate SUVR. Figure 2 illustrates the cloud effect in attenuating SUVR. The attenuation level depends on the cloud thickness and other optical properties.





The seasonal variation of the SUVR is shown in Fig.3 for a clear sky conditions from June to December, at this location, where the solar UV radiation is expected to attain relatively high intensity. A comparison between the graphs reveals that the amount of solar UV radiation increases from June to December.

It also reveals that the day length increases towards the summer time with the consequence that the amount of solar UV radiation impinging the earth's surface increases. This is theoretically, the expected behavior in terms of seasonal variation.

Conclusions and future work.

Public awareness, about health implication associated to SUVR exposure, can be successful achieved, by disseminating messages based on factual aspects that have to be identified and investigated for sustainability of the information issued to the society. The results reveal that Maputo (and probably the countrywide) receives high quantities of solar UV radiation throughout the year and it varies with day time and season. The peak values in winter are around 23 Wm^{-2} and in summer reach approximately 49 Wm^{-2}. The critical period during which people are strongly discouraged to expose to SUVR is between 10h: 00 and 14h: 00 since at this period it attains its stronger intensity.
On further step it is intended to investigate the real impacts of solar UV radiation in communities around the urban and suburban areas of Maputo. It is also intended to assess solar UV radiation, from different locations countrywide.